

# Claims

- [c1] A well logging tool, comprising:  
an induction array stack disposed on a mandrel;  
an electronic module stack disposed adjacent the induction array stack along a longitudinal axis of the well logging tool; and  
a shallow electrode array arranged on a housing disposed around the electronic module stack,  
wherein the induction array stack comprises a transmitter antenna, a first receiver antenna, and a second receiver antenna spaced apart from each other along the longitudinal axis of the well logging tool, the second receiver antenna being disposed between the transmitter antenna and the first receiver antenna.
- [c2] The well logging tool of claim 1, wherein the induction array stack is no more than 8 feet long.
- [c3] The well logging tool of claim 1, wherein the first receiver antenna is spaced apart from the transmitter antenna at about 45 inches.
- [c4] The well logging tool of claim 3, further comprising a first bucking coil disposed at a selected location between

the transmitter antenna and the first receiver antenna.

[c5] The well logging tool of claim 4, wherein the selected location is about 27 inches from the transmitter antenna.

[c6] The well logging tool of claim 1, wherein the second receiver antenna is spaced apart from the transmitter antenna at about 22 inches.

[c7] The well logging tool of claim 6, further comprising a second bucking coil disposed at a selected location between the transmitter antenna and the second receiver antenna.

[c8] The well logging tool of claim 7, wherein the selected location is about 16 inches from the transmitter antenna.

[c9] The well logging tool of claim 1, further comprising a third receiver antenna in the induction array stack, wherein the third receiver antenna is disposed between the transmitter antenna and the second receiver antenna at about 12 inches from the transmitter antenna.

[c10] The well logging tool of claim 9, further comprising a third bucking coil disposed at a selected location between the transmitter antenna and the third receiver antenna.

[c11] The well logging tool of claim 10, wherein the selected

location is about 9 inches from the transmitter antenna.

[c12] The well logging tool of claim 1, wherein the mandrel is conductive.

[c13] The well logging tool of claim 1, wherein the shallow electrode array comprises

- a central electrode;
- a first pair of measurement electrodes disposed at a substantially equal distance on both sides of the central electrode along the longitudinal axis of the well logging tool;
- a second pair of measurement electrodes disposed at a substantially equal distance on both sides of the central electrode along the longitudinal axis of the well logging tool, wherein each of the second pair of the measurement electrodes is disposed between the central electrode and one of the first pair of measurement electrodes;
- a pair of return-current electrodes disposed at a substantially equal distance on both sides of the central electrode along the longitudinal axis of the well logging tool, wherein each of the pair of the return-current electrodes is disposed between the central electrode and one of the second pair of measurement electrodes; and
- a pair of monitor electrodes disposed at a substantially equal distance on both sides of the central electrode

along the longitudinal axis of the well logging tool, wherein each of the pair of the monitor electrodes is disposed between the central electrode and one of the pair of return-current electrodes.

[c14] The well logging tool of claim 13, wherein the housing is no more than 8 feet long.

[c15] The well logging tool of claim 1, wherein a total length of the well logging tool is no more than 15 feet long.

[c16] The well logging tool of claim 1, wherein a total length of the well logging tool is no more than 13 feet long.

[c17] The well logging tool of claim 1, wherein the shallow electrode array and the induction array stack share the electronic module stack.

[c18] The well logging tool of claim 1, further comprising an electrode disposed on an end of the well logging tool.

[c19] A method for well logging using a tool comprising an induction array stack disposed on a mandrel; an electronic module stack disposed adjacent the induction array stack along a longitudinal axis of the well logging tool; and a shallow electrode array arranged on a housing disposed around the electronic module stack, wherein the induction array stack comprises a transmitter antenna, a

first receiver antenna, and a second receiver antenna spaced apart from each other along the longitudinal axis of the well logging tool, the second receiver antenna being disposed between the transmitter antenna and the first receiver antenna, the method comprising:  
disposing the tool in a wellbore;  
acquiring a first resistivity measurement using the first receiver antenna and a second resistivity measurement using the second receiver antenna;  
acquiring a shallow resistivity measurement; and  
processing the first resistivity measurement, the second resistivity measurement, and the shallow resistivity measurement to provide a formation resistivity.

- [c20] The method of claim 19, wherein the shallow resistivity measurement is acquired using the shallow electrode array.
- [c21] The method of claim 19, wherein the shallow resistivity measurement is acquired using a third receiver antenna disposed in the induction array stack.
- [c22] The method of claim 19, wherein the processing comprises correcting for shoulder effects and skin effects.
- [c23] The method of claim 19, wherein the processing comprises resolution enhancement.

